



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

THE AMERICAN NATURALIST.

VOL. XIX.—*MAY*, 1885.—No. 5.

SOME NEW INFUSORIA.

BY ALFRED C. STOKES, M.D.

A BITTER November wind out of a gray sky. A river as gray and cold, a little foam on its surface where the rocks fretted it. A group of bare trees ankle deep in their own leaves on a low bank whence bubbled a rill that seemed the only happy thing in the dreary landscape, while a shivering pedestrian shed involuntary tears as he filled his bottle with wet leaves and with water from the brook. A gloomy prospect and a gloomy day, but for compensation that bottle held a potentiality of infusorial wealth beyond the dreams of avarice. Not a tithe of the wonderful forms developed from the germs in that natural infusion could be noticed without making a paper of wearisome extent. To enumerate the individuals would be impossible. I can only present a half dozen taken at random.

As the infusion stood through the winter in a covered vessel, to which not a single drop of water was added except by the condensation of its own vapor on the cover, a source of endless interest to the writer has been to observe the sudden disappearance of the creatures which, for a week or two, had swarmed among the leaves by the thousand, and the equally sudden coming, from unsuspected and unknown spores, of as great a crowd of entirely different, more complex and more highly organized animalcules. Those higher in the scale devoured the lower, it is true, and did it without ceremony; but many died and melted away as their favorite food became exhausted or, for some other problematic reason, their surroundings became inauspicious. For weeks microscopic fungi flourished until the surface of the water bore a jelly-like layer a quarter of an inch deep, and Hypotrichous Infusoria, so huge that they were distinctly visible to the unaided vision, sported there in leaderless regiments and cohorts. But even that collection of fungi and bacteria disappeared, and the

water at this writing is as clear and limpid and sweet as that of a mountain spring, and not one of those gigantic *Hypotricha* is left. Yet the bowl is still a crowded infusorial menagerie. And not the least interesting fact is that most of those that have died as well as the living are new to science.

The lowest of those to which I desire now to refer, and perhaps the least abundant in its habitat, is a new member of the genus *Atractonema*, the threaded spindle, of Stein. Hitherto but one species has been observed, and that only by its discoverer. With it the body is much more fusiform than with this American animalcule, but the latter possesses all the generic characters of its foreign relative, and others which mark it as specifically distinct. The mouth in both is conspicuous, being especially so in this new form. The pharyngeal passage it is scarcely possible to overlook since it seems to communicate directly with the contractile vesicle. Whether the food passes into the pulsating vacuole, or through it, or to one side, are questions of interest that, so far as I am concerned, remain unanswered, as the creature has refused to take food when on the microscope stage. The single flagellum arises within the pharyngeal passage, a point on the wall, presumably the roof, serving as the basis of attachment. This structural feature is not mentioned, and probably does not exist in *Atractonema teres* Stein. The motion of the flagellum is very rapid, consisting of oscillations which give it the appearance of a figure of eight. That it is held stiffly coiled in that position and then vibrated, as is represented in the sketch (Fig. 1), I have been



FIG. 1.—
Atractonema
tortuosa, sp.
nov.

unable to determine. It has been engraved in that position because I desired to show the animalcule in its characteristic swimming attitude. When the *Atractonema* has been poisoned, preferably by iodine, preferably, of course, so far as the observer is concerned, the flagellum is uncoiled and straightened. The figure of eight aspect may therefore be illusory.

The animalcule's movements are by rapid writhing and twisting, at the same time rotating on its long axis. It is not changeable in shape, preserving its elongate, subcylindrical, somewhat vermicular form, except when in the agony of a toxicological death. It then coils and contorts itself like a wounded snake, temporarily flattening and expanding the body to a film. The character of the numerous dark-bordered

corpuscles within the endoplasm I do not know. *Chilomonas paramœcium* Ehr., for a long time the prevailing animalcule in the infusion, contains similar bodies which, under the influence of iodine, become intensely blue, and are therefore probably amylaceous. Those within *Atractonema*, under similar circumstances do not so change. The reproduction of the European species is by longitudinal fission. Multiplication of the American form has not been observed. Fig. 1 and the following description will probably be sufficient for diagnosis :

Atractonema tortuosa, sp. nov.—Body elongate, subcylindrical, soft and flexible but persistent in shape, seven to ten times as long as broad, tapering and pointed posteriorly, the anterior extremity narrowed, the frontal border truncate ; oral aperture terminal, conspicuous, followed by a tubular pharyngeal passage apparently connected by its posterior termination with the spherical contractile vesicle ; flagellum single, vibratile, about one-half as long as the body, issuing from the oral aperture and taking its origin from the wall of the pharynx at some distance from the frontal margin ; nucleus ovate, placed behind the body-center ; endoplasm colorless, transparent, enclosing numerous, oblong, dark-bordered corpuscles ; movements tortuous and rotatory on the long axis. Length of body $\frac{1}{600}$ to $\frac{1}{325}$ inch. Habitat : a vegetable infusion.

In the *American Journal of Science* for July, 1884, the writer described two new species of fresh-water infusoria under the generic title *Solenotus*, which was subsequently ascertained to be preoccupied in the Hymenoptera. Consequently, in the August number of the same journal, the name was changed to *Notosolenus*, the two members of the genus then being *Notosolenus (Solenotus) apocamptus* and *N. orbicularis*. The chief characteristics, aside from the persistent shape and an oral aperture, are the presence of a very short and inconspicuous trailing flagellum on the convex or ventral surface, and a longitudinal depression traversing the dorsal aspect, the infusorian thus appearing to swim on its back, since that part is expected to be more or less convex. Here, however, it is the ventral surface that is rounded.

When these animalcules were first obtained, although an anal aperture was observed and its location recorded, an oral orifice was not noted, and the systemic position of the infusoria was assumed to be among those forms which take food through any point on the surface, and near to Stein's *Colponema*. Since then, however, numerous specimens of both species have been observed, and although an oral aperture has not been actually discerned, yet the appearance of what seems to be a short pharyngeal tract is so constantly present that an oral orifice probably exists, and

the animalcules must therefore demand admission to the Flagellata-Eustomata of Saville Kent. The indurated character of the cuticular surface and the presence of green particles, apparently of food, within the endoplasm, would indicate the existence of a special mouth which would also be indirectly suggested by the appearance of the anal opening. The place of the genus in a systemic arrangement would therefore probably be, not in the neighborhood of Colponema but near Dujardin's Anisonema, differing from the latter, so far as the flagella are concerned, in having the shorter the trailing one, and the longer the vibratile, the converse of this being characteristic of Anisonema.

In the infusion a third species of Notosolenus has appeared. It is much depressed and almost triangular in form, the sloping sides being somewhat concave or undulate, and the truncate posterior extremity more or less emarginate, this emargination in some individuals increasing to a strongly marked concavity. Fig. 2 represents the creature in its ventral aspect with the extremity moderately uneven, and Fig. 3 another individual with a con-

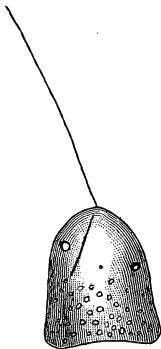


Fig. 2.

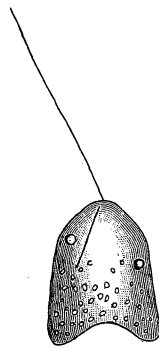


Fig. 3.

FIG. 2.—*Notosolenus sinuatus*, sp. nov., ventral. FIG. 3.—*N. sinuatus*, emarginate form, ventral.

spicuous emargination. Its endoplasm is very bright and transparent, being obscured only in the posterior part by granules and food particles. Its movement is forward in an almost direct course, the body elevated, the anterior apex in contact with the slide, the long flagellum held stiffly and obliquely in advance, its free end only vibrating, while the short flagellum, which appears to be of but little practical advantage to its owner, trails almost motionless below or above, for whether the animalcule shall float with the dorsal surface upward or beneath seems immaterial. It

advances across the field of view, stopping at any collection of débris in its path, examining it for food and departing with sudden turns and reversals of its course. The appearance of a pharyngeal tract is here more clearly defined than in the other species, and the infusorian is by far the largest of those hitherto observed.

Notosolenus (Solenotus) sinuatus, sp. nov.—Body depressed, broadly and irregularly ovate or subtriangular, somewhat longer than broad, widest posteriorly, gradually tapering through the posterior two-thirds, thence rapidly narrowing to the rounded frontal margin, the lateral borders frequently concave or undulate, the posterior extremity truncate, more or less emarginate; dorsal depression narrow, deep, with an anterior keel-like elevation; ventral surface smoothly convex; long flagellum vibratile at its distal end only, somewhat less than twice as long as the body, held stiffly and obliquely in advance towards the right-hand side; short or trailing flagellum about one-half as long as the body, usually extending obliquely backward toward the right-hand border; nucleus apparently single, spherical and near the center of the left-hand side, the contractile vesicle in front, and near the opposite margin; endoplasm colorless, transparent, posteriorly enclosing granules and green particles. Length of body $\frac{1}{1125}$, greatest width $\frac{1}{1500}$ inch. Habitat: standing water, with dead leaves.

When the growth of fungi and bacteria on the water was near its height, a *Paramœcium* appeared in profusion. It seems to be a distinct species, and one that can scarcely be mistaken for any known form, except possibly for *P. bursaria* (Ehr.) S. K., differing from the latter, however, conspicuously in form, especially in the apparently oblique curvature of the anterior extremity, in the absence of the truncation of the same part, the absence of the rapid and continuous circulation of the endoplasmic contents, and particularly the green coloration of the cortex and sarcode. The oral aperture of the form I have named *Paramœcium trichium*

is at the posterior extremity of the deep adoral fossa which gives the front part the appearance of being folded toward the left, and is followed by a distinct, ciliated pharynx (Fig. 4). The two contractile vesicles, instead of being placed one in each body-half, as in *P. bursaria*, are here anterior and close together, contracting quickly, the one beginning to reform almost before the completion of the other's systole. Trichocysts are very abundant, and are so arranged that they seem to elevate the cuticular surface into the minute hemispherical bosses that cover the entire

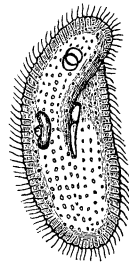


FIG. 4. — *Paramœcium trichium*, sp. nov., ventral. $\times 450$. FIG. 5.—Trichocyst.



FIG. 5.

body. When forcibly extruded through the influence of the glycerole of tannin, the distal end of each, for about one-tenth of the entire length, is conspicuously thickened, so that the trichocyst seems to be supplemented by the addition of a minute pyramid (Fig. 5). Occasionally, before the animalcule's death, when suffering from the application of a very dilute solution of the glycerole, it then gradually assuming an evenly ovoid form and becoming pale and ghostly, and always after the extrusion of the trichocysts and their removal from the body, the cuticular elevations are replaced by equally minute, regularly disposed, parallel-grammic depressions, as if the escaping trichocysts had left empty spaces which were filled by the sinking of the cortex. The nucleus and nucleolus are not always constant either in relation to each other or to a special part of the body. The former is sometimes, and normally it would seem, subcentrally located, yet sometimes being near the dorsum, again nearest the ventral surface, and still again in the anterior extremity, being seldom seen behind the body center. The laterally attached nucleolus is almost as uncertain in its relative connection with the nucleus, becoming at times entirely detached.

Conjugation has been observed, union taking place between the latero-ventral surfaces. Reproduction is by transverse fission, the nucleus previously becoming much elongated, the dividing plane passing through its center. In some instances, soon after the beginning of genetic union, the nucleus assumes a finely striated appearance, gradually growing more and more indistinct in contour until it finally becomes indistinguishable from the surrounding endoplasm.

Paramœcium trichium, sp. nov.—Body soft and flexible, ovate, somewhat compressed, three times as long as broad, widest and slightly inflated posteriorly, both extremities rounded, the ventral surface somewhat flattened; adoral fossa extending to the center of the ventral aspect from the left obliquely toward the right, deepest and widest anteriorly, this part of the body apparently folded obliquely toward the left-hand side; oral aperture followed by a distinct, tubular, ciliated pharyngeal passage; trichocysts abundant, arranged vertically and apparently elevating the cuticular surface into the numerous, parallel, longitudinal series of minute hemispherical projections roughening the entire body and giving it in optical section a crenulated outline, their distal extremities, when forcibly extruded, conspicuously and pyramidally thickened; nucleus ovate, usually subcentrally placed, with a laterally attached nucleolus; contractile vesicle double, spherical, anteriorly located; anal aperture ventro-terminal. Length of body $\frac{1}{300}$, of trichocysts $\frac{1}{1000}$ inch. Habitat in the jelly-like mass of fungoid and bacterial growth on the surface of an infusion of dead leaves.

Attached to the sides of the vessel, to fragments of leaves or indeed to almost any basis of support, were many mucilaginous, coarsely granular zoöcytia formed and inhabited by an animalcule generically distinct from all previously known infusoria. The sheath or zoöcytium is very soft and shapeless, and variable both in size and in number of its occupants. It appears to be formed primarily by a thin exudation from the creature's body that would be nearly invisible were it not for the extraneous particles, spores, bacteria and débris of all kinds that adhere to the surface, and especially for the zoöid's excrementitious matter which seems to be the principal building material and the cause of the coarsely granular aspect. It is not uncommon to find a small colony produced by the mutual union, and probably by a mutual formation of adjacent zoöcytia, the resultant of this adhesion being a non-descript mass of flocculent matters from under shelter of which the animalcules project, and when startled by the approach of a larger infusorian, or from other cause, quickly glide backward to the posterior part of their semi-transparent dwelling. These zoöcytia are frequently attached to vegetable fragments or to masses of residual detritus so that they would be an almost indistinguishable part of the granular aggregation were it not for the presence of the living infusorian. Indeed, when deserted these formations cannot be separated by the eye from other flocculent clusters so often in the field. Yet the creature forms them, apparently involuntarily, for soon after a frightened zoöid comes to rest, rejected particles in the food-bearing current begin to mark the outlines of the mucilaginous excretion which soon increases in size by the adhesion of everything that touches it.

The infusoria (Fig. 6) are ovate in form and entirely ciliated. The oral aperture is at the posterior extremity of a median depression occupying the anterior one-third of the ventral surface and bearing on its right-hand margin a row of curved, cirrose cilia. From the frontal border projects a cluster of long, distally curved hairs which by their

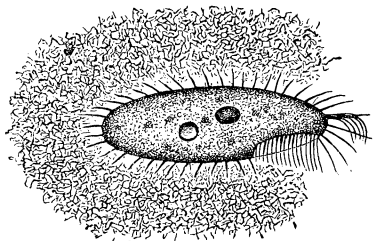


Fig. 6.—*Cyrtolophosis mucicola*, gen. et sp. nov.

constant and rapid downward lashing, force a current into the adoral groove and against the row of strong non-vibratile cilia on

the right-hand side of the mouth, thus supplying that ever-ready mouth with food. On such occasions the surface cilia behind the position of the oral aperture are in only irregular and uncertain vibration, while those on the frontal border, including the curved fascicle, are in the most active motion, being only momentarily visible, the right-hand ciliary fringe, under an insufficient amplification, then presenting the aspect of a single short seta, or a narrow lip, projecting from the posterior angle of the excavation. When the zooids have been for some time under the thin cover, they voluntarily leave the old zoöcytium, swimming rapidly and occasionally settling on the slide to form a new and equally structureless protective covering. If a convenient collection of miscellaneous débris is accidentally encountered, the wandering infusorian often takes refuge beneath it, there gliding backward when threatened, as it did so conspicuously in its original home, the long anterior cilia then streaming out at the front.

Cyrtolophosis (κυρτος, curved; λοφωσις, wearing a crest), gen. nov.—Animalcules ovate, persistent in shape, entirely ciliate, the adoral cilia differing from those of the general surface, the anterior extremity bearing a fascicle of long distally curved, vibratile hairs; secreting and inhabiting a variously modified, mucilaginous, granular zoöcytium, to which they are in no way attached and from which they may pass at will; oral aperture at the posterior extremity of an excavated, elongated groove, longitudinally traversing the anterior part of the ventral surface, bearing on its right-hand margin a series of cirrose, adoral cilia; nucleus and contractile vesicle single, conspicuous; anal aperture postero-terminal.

Cyrtolophosis mucicola, sp. nov.—Body ovate, two and one-half to three times as long as broad, both extremities rounded, narrowed anteriorly, the ventro-frontal border obliquely truncate; anterior cilia longest, those of the general surface setose, the anteriorly placed fascicle of distally and downwardly curved cilia conspicuous; adoral depression extending from the frontal border for one-third the length of the entire body; adoral cilia cirrose, curved, diminishing in length toward the oral aperture; contractile vesicle single, spherical, posteriorly placed near the right-hand lateral border; nucleus subspherical, subcentrally located. Length of body $\frac{1}{900}$ to $\frac{1}{1000}$ inch. Zoöcytia solitary or variously united. Habitat: an infusion of dead leaves. Reproduction by transverse fission.

Another infusorian, bearing a carapace and having the adoral fringe on the left-hand margin of the peristome, and therefore undoubtedly a member of the Euplotidæ, proved to be an undescribed species of the curious Euplotes, animalcules whose ventral styles are not only used for swimming but as ambulatory organs. They are often seen walking over the slide and among the masses of débris usually present, apparently swimming only when food is exhausted in that locality and they must journey

further to seek it. The form now referred to differs from all others in the number of the frontal styles, the character and arrangement of the anal styles and caudal setæ, and in the shape of the carapace, which has a very conspicuous keel or high acute ridge traversing the dorsum from the frontal to the posterior borders. In Fig. 7 is shown the ventral aspect with the ambula-

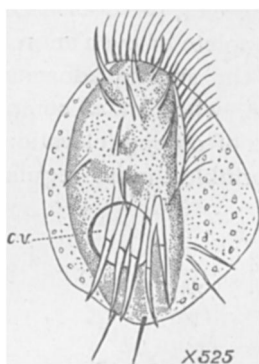


Fig. 7.

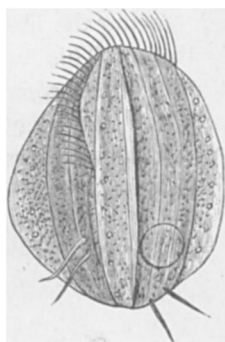


Fig. 8.

FIG. 7.—*Euplotes carinata*, sp. nov., ventral aspect. FIG. 8.—The same in dorsal aspect.

tory organs and setæ; in Fig. 8 the upper surface of the carapace with the central keel that suggested the specific name.

Euplotes carinata, sp. nov.—Carapace irregularly suborbicular, the frontal and right-hand borders evenly rounded, the posterior margin convex and usually emarginate on the right-hand side, the left-hand border rounded but obliquely truncate in opposite directions, thus forming a subcentral rounded protruding angle; dorsal surface traversed by a single conspicuous median and longitudinal keel or acute ridge, and by four to six longitudinal furrows; seven frontal, three scattered ventral and five straight simple anal styles; four unbranched caudal setæ, the two on the left-hand side close together but remote from the margin; peristome-field narrow, arcuate, the posterior third of the right-hand border ciliated; nucleus band-shaped, long, semi-circular. Length of carapace $\frac{1}{3}\frac{1}{8}$, greatest width $\frac{1}{5}\frac{1}{10}$ inch. Habitat: standing water with dead leaves.

In the *American Monthly Microscopical Journal* for Dec., 1884, the writer described a *Euplotes* under the specific title of *plumipes*, so naming it on account of the beautifully fimbriated condition of the anal styles; but the figure there published represented a few of the adoral cilia in an incorrect position. Through the kindness of Dr. Packard I am able to present here a corrected drawing (Fig. 9) of the same interesting infusorian with the description. My pleasure in doing so is increased not only by the

opportunity to correct my own oversight, but because I can again ask attention to one of the most beautiful American members of the genus.

The carapace of *E. carinata* is somewhat irregularly marked by small circles formed of minute dots visible through the transparent borders. This ornamentation is variable, however, as is probably the case in all the decorated species, the dots becoming scattered, leaving the little circles incomplete or even entirely destroying them. This variableness in the surface adornment is also apparent in *E. plumipes*, but there, when most completely developed, the ornamentation consists of oblong elevations arranged in stellate clusters which are sprinkled quite regularly in

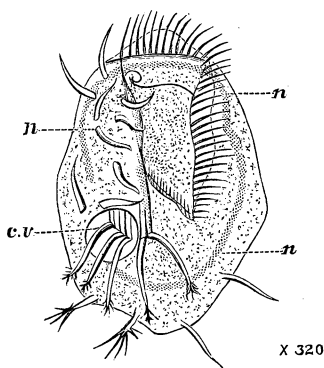


Fig. 9.

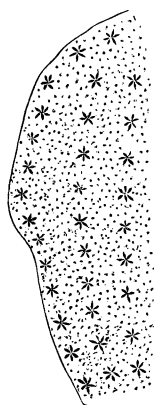


Fig. 10.

FIG. 9.—*Euplotes plumipes* Stokes. FIG. 10.—Ornamentation of the carapace.

longitudinal lines over a surface already roughened by minute dots. The result is very pleasing to the eye, and adds another item of interest to the infusorian which seems to be one of the bravest and most self-reliant of its class, walking or swimming boldly and steadily forward as if with some object of vital import in view. This ornamentation is shown in detail in Fig. 10.

Euplotes plumipes Stokes.—Carapace irregularly suborbicular or elliptical, the anterior margin truncate, often minutely crenulate or beaded, the upper lip crescentic and conspicuously projecting; posterior margin rounded, usually with a shallow emargination on the right-hand side of the median line; right-hand border rounded or somewhat flattened and undulate; the anterior and posterior halves of the left-hand border commonly obliquely truncate in opposite directions and forming centrally a projecting and rounded angle or keel-like protuberance; peristome field

wide, triangular, the upper right-hand corner prolonged in a sinistrally directed helicoidal curvature, posteriorly extending beyond the center of the ventral surface, the cilia of the anterior and left-hand borders large and cirrose, the posterior third of the right-hand margin ciliated; six frontal, three ventral and five anal styles, the extremities of each of the last finely fimbriated; caudal setæ four, the two on the right-hand side of the median line much branched; dorsal surface convex, without longitudinal furrows, minutely roughened and often ornamented by longitudinal rows of equidistant elevations formed of minute prominences arranged in stellate clusters; nucleus band-like, curved, very long, extending around nearly the entire periphery, its extremities separated by a short interval near the right-hand body margin; anal aperture in close proximity to the contractile vesicle. Length of carapace $\frac{1}{200}$ inch. Habitat: pond water, near the bottom.

Conjugation is accomplished through the union of two individuals by the left-hand half of the ventral surfaces, and multiplication is by transverse fission. The first apparent change preceding the latter act is the development of a series of cilia almost parallel with the left-hand margin of the peristome, while from the comparatively vacant space over which the ventral styles are scattered, the zoöid gradually extrudes fourteen new styles, a second contractile vesicle appears, and the infusorian then presents the interesting aspect of a *Euplotes* with a double row of adoral cilia, two pulsating vacuoles, four caudal setæ and twenty-eight ambulatory styles. The body quite rapidly elongates until about twice the ordinary length, and separates across the middle, distributing the twenty-eight styles so that the anterior moiety preserves the old frontal and ventral ones, taking five of the new for its anal supply and extruding four fresh caudal setæ. The posterior portion therefore has the newly formed frontal and ventral and the old anal styles, with the old caudal setæ. But before the final separation the posterior animalcule extrudes four additional caudal setæ, then having twice as many as the normal complement, gradually and in irregular sequence absorbing the four old and now unwelcome and useless ones, those that are branched being the last to appear and the last to be absorbed.